

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/JP2005/010639

International filing date (day/month/year)
03.06.2005

Priority date (day/month/year)
10.06.2004

International Patent Classification (IPC) or both national classification and IPC
C22F1/18

Applicant
YAMAHA HATSUDOKI KABUSHIKI KAISHA

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:



European Patent Office - P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk - Pays Bas
Tel. +31 70 340 - 2040 Tx: 31 651 epo nl
Fax: +31 70 340 - 3016

Authorized Officer

Rischard, M

Telephone No. +31 70 340-4776



WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITYInternational application No.
PCT/JP2005/010639

Box No. I Basis of the opinion

IAP20 Rec'd PCT/JP 11 JAN 2006

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
 - ☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material:
 - ☐ in written format
 - ☐ in computer readable form
 - c. time of filing/furnishing:
 - ☐ contained in the international application as filed.
 - ☐ filed together with the international application in computer readable form.
 - ☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/JP2005/010639

Box No. V Reasoned statement under Rule 43b/s.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	2-7,14-17
	No: Claims	1,8,9,10,11,12,13
Inventive step (IS)	Yes: Claims	2-7,14-17
	No: Claims	1,8,9,10,11,12,13
Industrial applicability (IA)	Yes: Claims	1-17
	No: Claims	

2. Citations and explanations

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING
AUTHORITY (SEPARATE SHEET)**

International application No.

PCT/JP2005/010639

IAF20 Received 11 JAN 2006

Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

1. Reference is made to the following documents:

- D1: PATENT ABSTRACTS OF JAPAN vol. 010, no. 377 (C-392), 16 December 1986 (1986-12-16) - & JP 61 170551 A (TOUGOU SEISAKUSHO:KK), 1 August 1986 (1986-08-01)
- D2: WAGNER L.: "Mechanical surface treatments on titanium, aluminium and magnesium alloys" MATERIALS SCIENCE AND ENGINEERING, vol. A, no. 263, 1999, pages 210-216, XP002348035 cottbus, germany
- D3: DE 195 17 275 A1 (BREHM, PETER, 91085 WEISENDORF, DE) 14 November 1996 (1996-11-14)

2. The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 is not new in the sense of Article 33(2) PCT.

2.1 Document D1, which is considered the closest prior art for independent claim 1, discloses:

A titanium alloy part subjected to a multiple peening process [abstract], having a residual compressive stress of 72 kgf/mm² (705 MPa) at a depth of 100 µm from the surface [fig. 1, sample A].

The subject-matter of claim 1 is therefore not new.

Furthermore, document D2 discloses a probe of metastable β -alloy Ti-3Al-8V-6Cr-4Mo-4Zr subjected to a single shot peening, having a residual compressive stress of 520 MPa at a depth of 100 µm from the surface [fig. 5]. Therefore, claim 1 is also not new in view of document D2.

2.2 The subject-matter of claim 1 does not rely on an inventive activity according to article 33(3) PCT either, because a titanium part with a compressive stress layer of more than 270 MPa at a depth of 100 μm from the surface is known in the technical field.

3. Claims 8 and 9 do not fulfill the requirements of the PCT for novelty and inventive step, because the titanium alloy part they refer to is known [see §1].

4. Document D3 appears to be prejudicial to the novelty of independent claim 10. This document discloses:

A process for producing a prosthesis of TiAl6Nb7 [col.1,l.6], comprising the steps of providing the prosthesis, shot peening the surface with steel beads in order to induce compressive stress in the surface layer and subsequently peening with glass beads to remove unwanted material introduced by the former step [col.2,l.19-41]. It can be assumed that the glass beads contain SiO_2 particles.

The subject-matter of claim 10 is therefore not new.

4.1 In the present form, claim 10 does not involve an inventive activity according to article 33(3) either, as the disclosed process is not new.

5. Dependent claims 11 to 13 do also not fulfill the requirements of the PCT concerning novelty and inventive step, as the features thereof are implicitly disclosed by document D3.

6. Notwithstanding the clarity objection under point VIII. the subject-matter of claim 2 differs from document D1 by a low concentration of brittle α -titanium in the surface layer after finishing, leading to an improved resistance against crack initiation.

6.1 The problem to be solved by claim 2 is to provide a titanium alloy part having undergone a compressive stress inducing treatment, with a further enhanced fatigue resistance.

6.2 The solution to this problem proposed in claim 2 of the present application is considered to involve an inventive activity (Article 33(3) PCT) for the following reasons:

None of the prior art on file relates to the detrimental effect of strain induced α -phase on the fatigue behaviour of titanium alloys. Therefore, the proposed solution to mechanically or physically reduce the thickness of this layer in a titanium part having undergone a compressive stress inducing treatment is not obvious for the skilled person.

7. The claims 3 to 7 insofar as they are dependent on claim 2 also fulfill the requirements of the PCT concerning novelty and inventive step.

8. The subject-matter of claim 14 differs from document D3 by the second peening step removing a specific thickness of the surface layer. Claim 14 is therefore new according to article 33(2) PCT.

8.1 The problem solved by claim 14 is to provide a process for improving the fatigue resistance of a titanium alloy part beyond the known techniques of multiple shot peening or abrasive cleaning followed by shot peening.

8.2 Claim 14 also involves an inventive activity according to article 33(3) PCT, for the following reasons:

The technical effect of the invention clearly differs from document D3 where the abrasive blasting is applied to remove unwanted particles from the surface and to improve the biocompatibility of a prosthesis. There is no prior art on file which gives a hint on how to apply abrasive blasting as a final process step to remove at least part of the strain-induced α -phase on the surface.

9. Claims 15 to 17 insofar as they are dependent on claim 14 also fulfill the requirements of the PCT concerning novelty and inventive activity.

Re Item VIII

Certain observations on the international application

The definition of the "modified layer" in claim 2 in relative terms is unclear according to article 6 PCT, as it leaves the reader in doubt as to the actual composition of this layer and its thickness.